

1 MINIATURE VIBRATION MOTOR STRUCTURE

2 Background of the Invention

3 1. Field of the Invention

4 The present invention relates to a miniature vibration motor structure,
5 and more particularly to a miniature vibration motor structure that is easily
6 manufactured, and has a better vibration effect.

7 2. Description of the Related Art

8 A conventional miniature vibration motor structure in accordance
9 with the prior art shown in Fig. 1 comprises an upper casing 90 and a lower
10 casing 91 secured with each other. The upper casing 90 is provided with a seat
11 92 protruding upward, and the lower casing 91 is also provided with a seat 92
12 protruding downward. A bearing 93 is received in the seat 92. A central shaft
13 94 is pivoted with the upper and lower bearings 93. The central shaft 94 is
14 fitted with a counterweight 95 that is combined with a rotor 96. The outer
15 periphery of the rotor 96 has a permanent magnet 97 induced with a coil seat
16 98. The counterweight 95 of the rotor 96 is partially recessed to form a recess
17 99, so that vibration is generated during rotation of the rotor 96.

18 The conventional miniature vibration motor is usually available in
19 the communication equipment, such as a calling machine, a mobile telephone
20 (or cellular phone) or the like. The design of the communication equipment is
21 required strictly to be light, thin, and small. However, in the construction of
22 such a kind of conventional miniature vibration motor, the upper casing 90 is
23 provided with a seat 92 protruding upward, and the lower casing 91 is also
24 provided with a seat 92 protruding downward for receiving the bearing 93,
25 while the outer side of the central shaft 94 is fitted with the casing. Thus, the
26 conventional miniature vibration motor has multiple parts, thereby causing
27 inconvenience in assembly and fabrication, and relatively, the thickness and

1 volume thereof cannot be reduced easily. In addition, in the conventional
2 vibration motor, the rotor 96 has a counterweight 95, thereby forming a radial
3 vibration. Thus, the vibration effect is limited and is not apparent.

4 **Summary of the Invention**

5 The primary objective of the present invention is to provide an
6 improved miniature vibration motor structure wherein the miniature vibration
7 motor has a simpler construction, is easily assembled, and has a smaller
8 volume and thickness.

9 A secondary objective of the present invention is to provide an
10 improved miniature vibration motor structure wherein the miniature vibration
11 motor has a better radial and axial vibration effect.

12 In accordance with the present invention, there is provided a
13 miniature vibration motor structure includes an upper plate and a lower plate
14 each having a seat hole for receiving each of two ends of a shaft column in a
15 non-tight fit manner. The shaft column passes through the shaft hole of the
16 bearing of the rotor in a loose fit manner. The annular permanent magnet is
17 integrally formed on an outer periphery of the bearing. Thus, when the rotor is
18 rotated, the center of gravity and the center of rotation of the rotor are not at the
19 same central line. The stator seat wound with a coil has poles which may be
20 induced with the permanent magnet of the rotor, so as to drive the rotor to
21 rotate.

22 Further benefits and advantages of the present invention will become
23 apparent after a careful reading of the detailed description with appropriate
24 reference to the accompanying drawings.

25 **Brief Description of the Drawings**

26 Fig. 1 is a cross-sectional assembly view of a conventional miniature
27 vibration motor structure in accordance with the prior art;

1 Fig. 2 is an exploded perspective view of a miniature vibration motor
2 structure in accordance with a first embodiment of the present invention;

3 Fig. 3 is a cross-sectional assembly view of the miniature vibration
4 motor structure as shown in Fig. 2;

5 Fig. 4 is a locally enlarged view of the miniature vibration motor
6 structure of portion 4 as shown in Fig. 3;

7 Fig. 5 is a locally enlarged view of the miniature vibration motor
8 structure of portion 5 as shown in Fig. 3;

9 Fig. 6 is an exploded perspective view of a miniature vibration motor
10 structure in accordance with a second embodiment of the present invention;
11 and

12 Fig. 7 is a cross-sectional assembly view of the miniature vibration
13 motor structure as shown in Fig. 6.

Detailed Description of the Preferred Embodiments

15 Referring to the drawings and initially to Fig. 2, a miniature vibration
16 motor structure in accordance with a first embodiment of the present invention
17 comprises a housing 1, a stator seat 2, and a rotor 3.

18 The housing consists of an upper plate 1a and a lower plate 1b each
19 having a seat hole 11 for receiving each of two ends of a shaft column 3. In the
20 preferred embodiment, each end of the shaft column 13 may be formed with a
21 reduced diameter portion 14 which is non-tightly inserted into the seat hole 11.
22 The lower plate 1b may be a fixing plate such as a circuit board or a base plate.
23 An annular wall is combined between the upper plate 1a and the lower plate 1b,
24 for receiving the stator seat 2, so that the stator seat 2 is covered and protected.

25 The stator seat 2 is wound with a coil 21, and has a power inlet 22 for
26 supplying the electric power into the stator seat 2. The stator seat 2 has poles 23

1 which may be induced with the permanent magnet 32 of the rotor 3, to drive
2 the rotor 3 to rotate.

3 The rotor 3 includes a bearing 31, and an annular permanent magnet
4 32 integrally formed on the outer periphery of the bearing 31. The center of the
5 bearing 31 of the rotor 3 has a shaft hole 33 for passage of the shaft column 13.
6 The bearing 31 is loosely fitted with the shaft column 13, so that the bearing 31
7 of the rotor 3 may be rotated on the shaft column 13. The permanent magnet 32
8 of the rotor 3 is induced with the poles 23 of the stator seat 2, so that the rotor 3
9 can be driven to rotate. In the preferred embodiment, the center of gravity and
10 the center of rotation of the rotor 3 are not at the same central line. The bearing
11 31 or the annular permanent magnet 32 may be provided with a recess, a
12 protruding block, or embedded with an insert having different material and
13 specific gravity. As shown in the figure, in the preferred embodiment, the rotor
14 3 is provided with a recess 34. Thus, the rotation of the rotor 3 will form an
15 unbalanced vibration.

16 Referring to Figs. 3-5, the miniature vibration motor structure in
17 accordance with the first embodiment of the present invention is assembled.
18 The reduced diameter portion 14 of each of the two ends of the shaft column 3
19 is directly inserted into the seat hole 11 of the upper plate 1a and the lower
20 plate 1b of the housing 1. The reduced diameter portion 14 of the shaft column
21 3 and the seat hole 11 are non-tightly combined with each other. The bearing
22 31 of the rotor 3 is fitted on the outer wall of the shaft column 13, while the
23 bearing 31 of the rotor 3 and the outer wall of the shaft column 13 are non-
24 tightly combined with each other. Thus, when the rotor 3 is rotated, the
25 permanent magnet 32 of the rotor 3 is induced with the poles 23 of the stator
26 seat 2, so that the bearing 31 and the permanent magnet 32 are rotated relative
27 to the shaft column 13. The center of gravity and the center of rotation of the

1 rotor 3 are not at the same central line. Thus, the rotation of the rotor 3 will
2 form an unbalanced vibration. In addition, the bearing 31 and the shaft column
3 13 are non-tightly fitted with each other, while the shaft column 13 and the seat
4 hole 11 of the upper plate 1a and the lower plate 1b of the housing 1 are also
5 non-tightly fitted with each other. Thus, the rotation of the rotor 3 may form an
6 unbalanced vibration with an eccentric rotation, and the rotor 3 may also form
7 axial upward and downward vibration along the shaft column 13, so that the
8 miniature vibration motor structure in accordance with the present invention
9 will have a better vibration effect.

10 Referring to Figs. 6 and 7, in accordance with a second embodiment
11 of the present invention, a fixing plate 4 formed by a circuit board, a base plate
12 or the like is provided with a shaft connecting hole 41, and a plurality of
13 positioning holes 42. The shaft connecting hole 41 of the fixing plate 4 may
14 allow insertion of the reduced diameter portion 44 of one end of the shaft
15 column 43, and the reduced diameter portion 44 of the other end of the shaft
16 column 43 is inserted into the shaft connecting hole 46 of a housing 45. The
17 housing 45 is provided with a plurality of locking blocks 47 locked in the
18 positioning holes 42 of the fixing plate 4. Thus, the shaft connecting hole 41 of
19 the fixing plate 4 and the shaft connecting hole 46 of the housing 45 may allow
20 insertion of the reduced diameter portion 44 of each of the two ends of the
21 shaft column 43 in a non-tight fit manner. The shaft column 43 passes through
22 the shaft hole 33 of the bearing 31 of the rotor 3.

23 The rotor 3 includes a bearing 31, and an annular permanent magnet
24 32 integrally formed on the outer periphery of the bearing 31. The bearing 31
25 or the annular permanent magnet 32 may be provided with a recess 34, a
26 protruding block, or an insert having different material and specific gravity
27 may be embedded in the recess 34. Thus, the center of gravity and the center of

1 rotation of the rotor 3 are not at the same central line. Therefore, when the
2 permanent magnet 32 of the rotor 3 is induced with the poles 23 of the stator
3 seat 2 to drive the rotor 3 to rotate, the rotation of the rotor 3 will form an
4 unbalanced vibration. Thus, the center of gravity and the center of rotation of
5 the rotor 3 are not at the same central line, so that the rotation of the rotor 3 may
6 form an unbalanced vibration with an eccentric rotation, and the rotor 3 may
7 also form an axial vibration along the shaft column 43.

8 Accordingly, in the improved miniature vibration motor structure in
9 accordance with the present invention, the bearing of the rotor is rotated
10 relative to the shaft column, and the reduced diameter portion 44 of each of the
11 two ends the of the shaft column 43 is combined with the seat hole or the shaft
12 connecting hole in a non-tight fit manner. Thus, when the rotor is rotated, the
13 center of gravity and the center of rotation of the rotor 3 are not at the same
14 central line, so that rotation of the rotor 3 may form an unbalanced vibration
15 with an eccentric rotation, and the rotor 3 may also form axial vibration along
16 the shaft column. Thus, the miniature vibration motor structure in accordance
17 with the present invention will have a better vibration effect. In addition, in the
18 miniature vibration motor structure in accordance with the present invention,
19 the reduced diameter portion 44 of each of the two ends the of the shaft column
20 43 is inserted into the seat hole or the shaft connecting hole in a non-tight fit
21 manner. Therefore, the miniature vibration motor structure in accordance with
22 the present invention is easily assembled and manufactured.

23 Although the invention has been explained in relation to its preferred
24 embodiment as mentioned above, it is to be understood that many other
25 possible modifications and variations can be made without departing from the
26 scope of the present invention. It is, therefore, contemplated that the appended

- 1 claim or claims will cover such modifications and variations that fall within the
- 2 true scope of the invention.